



Crossing Sensory Boundaries with Creative Productions

Predrag K. Nikolić¹  and Nancy L. Russo²

¹ School of Creativity and Art, ShanghaiTech University, 393 Huaxia Middle Road, Pudong, Shanghai 201210, China

predragnikolic@shanghaitech.edu.cn

² Faculty of Technology and Society, Malmö University, Nordenskiöldsgatan 1, 211 19 Malmö, Sweden

nancy.russo@mau.se

Abstract. We seek to investigate possibilities of extending the emotional and cognitive experience of using products or services through the cross-modality of vision with other senses (synesthesia). Through multi-sensory, interactive environments, consumers become more engaged in the use of a product or service and may, in fact, participate as co-creators of their own experiences. To achieve the highest level of spontaneity and provoke human activation to enable us to study this, we suggest an experimental context based on interactive technologies, aesthetics and design. For this purpose, we use an artistic environment in the form of an interactive installation. Two examples of such experimental interactive art installations, Art Machine: Mindcatcher and Re-Digital, are described in this paper.

Keywords: Synesthesia · Cross-modal experience · Interactivity · Interaction design · Multisensory interface design · User experience · Product design · Service design

1 Introduction

Synesthesia is a combination of several senses simultaneously. It is psychological phenomena where stimuli on one particular physical sensory can produce additional sensory experiences for which sensory inputs which do not exist [1]. It is an unusual condition which gives rise to a merging of the senses. For example, smells may trigger the experience of shapes, or letters may give rise to the perceptual experience of color or may cause the experience of any combination of tastes, smells, shapes or sensations [2]. One of the most reported types of synesthesia is audio-visual (AVS) [3], where sound stimuli can evoke the visual experience and vice versa. In particular, sound such as middle note ‘C’ can induce red color experience but the same note three octaves higher can become green [4]. Likewise, we can have different varieties of the sense responses on sensory stimulation such as; taste a particular food (gustatory) can associate us to the visual appearance of the food [5]; when we hear a certain sound (auditory) can induce smell of a specific food (olfactory) [6]. Despite early skepticism, contemporary research in the

© ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2020

Published by Springer Nature Switzerland AG 2020. All Rights Reserved

H. Santos et al. (Eds.): SmartCity 360 2019, LNICST 323, pp. 420–427, 2020.

https://doi.org/10.1007/978-3-030-51005-3_34

field shows that synesthesia exists, moreover it has potential to manifest as a conscious phenomenon and involve robust qualitative phenomenology [7]. Often, synesthesia is misunderstood as simple metaphor people are addressing to different emotional or perceptual phenomena, such as color perception (e.g., most of the people will address anger to red color). In fact, it is unique type of phenomenal experiences triggered without direct sensory stimulation [1]. Perhaps these misunderstandings are why the phenomenon was considered as unreliable for over a century after its discovery by Francis Galton [8]. In the last decade we can follow increased interest in the cross-sensory experiences and raising interest in synesthesia as its correlated phenomena [9, 10] especially because people can generate rich mental images for the other senses as well, beside the most commonly though visual experience. For example, multisensory advertising approach uses different combination of senses to stimulate consumers' other sensory perceptions related to product or service [11]. In line with that, the design experience has become a sensual fusion of the human and the product, a form of interaction that is dependent upon the user's presence and bodily actions [12].

2 Interactivity and Strategy of Participation

Interactivity has a long history as an essential conceptual component of the field of arts and design. Theorist and writer Jack Burnham were one of the first who pointed on interactivity as a conceptual approach in art. He related it to two-way communication between artwork and visitors seen as kind of premature attempts in happenings, kinetic art, and luminous art [13]. Unfortunately, in those cases the individual is physically passive, unable to affect the work, interaction is happening on an only psychological level. Roy Ascott's 1959 *Change Painting* is an early example of an artwork which had the tendency to involve the audience in a directly physical way. Furthermore, in his work, he empathizes the correlation between the act of changing and elicited aesthetic experience in the participant. As a result of his early conceptual ideas, in 1966 he coined a new term *Behaviourist Art* [14]. This concept represents the possibility of using a system such as in *Change Painting* as an interface between the author and the audience. Between the late 1960s and early '70s, the concept of Ascott's *Behavior Art* highly reflected on the work of British artist Stephen Willats. He created a new form of art conceptually inspired by techniques of cybernetics and the behavioural social sciences [15]. Willats believed that the main purpose of art is to change human understanding and behaviour. His artistic strategy involved usage of market research, social survey and feedback methods to involve different social groups in the act of interaction with the artworks [16].

Furthermore, the concept of creative interaction evolved throughout time and embraced any project based on an interactive strategy of participation [17]. This means that the participant is invited to take part in a product prototype under rules and constraints which are part of a designed system and not the interactive process itself. In our research practice, we consider redefining the users as a creative source as one of the fundamental purposes of interactive art [18]. When users become a creative source, they are not simply consumers of the product of the artistic or design process but instead become co-creators (along with the artist, designer, and even other users) through interaction

with the prototype. In some of the previous researches has been specified that in interactive systems psychological outcomes associated with digital interaction includes cross-modal correspondences perceived by multisensory modalities [19], enhanced learning, entertainment, and persuasive effects [20, 21].

3 Re-Thinking the Interface Toward Multisensory Products

The way we feel and understand the world around us through our senses. They are many studies who are exploring phenomena of perception and relationship between the usage of multiple sensory modalities and its effect on user experience. The more stimuli engaged at the same time can evoke the richer experiences, higher impact and make it more memorable across different senses [22–24]. Likewise, the higher number of sensory inputs in a virtual environment could increase people’s sense of presence as well as improve awareness related to virtual objects placement [25]. In such cases, we are using different types of a multisensory interface as a medium between us and non-physical, virtual space we are interacting and abstract world we are experiencing. Such interfaces can offer significant advantages, not only to already mentioned online advertising but even more important to synesthetic repertoire of assistive products capable to help people with disabilities such as blindness [26].

With the only screen, mouse, keyboard and tactile gestures we are becoming limited in controlling, changing and responding to a variety of new digital inputs. In such situation available physical repertoire of body actions have the potential to respond to raising new interaction design needs. This interface design conceptual approach leads us to several questions important to answer such as: How to diminish the isolation between person and interface and to make the interface disappear? How to extend an interface more widely into human life? How to create a understandable interactive sensing and vocabulary of human actions such as motion, gesture, touch, gaze, speech, and interactions with physical objects?

In the interactive installation *Art Machine: MindCatcher* our goal was to investigate different qualities of multisensory user experience achieved through the usage of body movement-based interface and audio-visual sound response and to relate them to visitor perception. Like Monika Fleischmann in her work *Rigid Waves* [27], we explored through artwork innovative interfaces such as immersive virtual reality touch, balance, and motion or like Rafael Lozano-Hemmer who explored in his installation *Re: Positioning Fear* integrated physical and virtual spaces by motion and gestures [28].

The *Art Machine: Mindcatcher* installation was conceptualized on the usage of audio-visual digital outputs as an incentive for users’ interactions and creative actions. The outputs consisted of three colours; red, blue, yellow (visually), three tones C, G, E (auditory), three sized circles (Fig. 1), and a touch-sensitive floor (tactile) as the interactive medium between artwork as a paradigm of product and participant as a consumer. By pressing differently lightened switches on the interactive floor interface visitors were capable of achieving multisensory experience within the installation space. (Figure 2). The digital outputs could have been controlled and modulate based on switch sensor choice and foot pressure duration on it.

A second experimental project, *Re-Digital* was designed in two parts: one is exposed in public space as garbage cans and the second part is a web location where

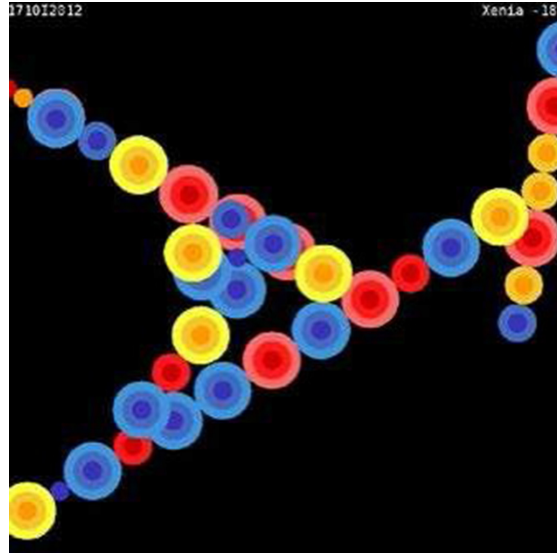


Fig. 1. Art Machine: MindCatcher Visualization (photo copyrights: Predrag K. Nikolic) (Color figure online)



Fig. 2. Art Machine: MindCatcher Floor Interface (photo copyrights: Predrag K. Nikolic)

everyone can upload files - “digital garbage” - and make it available for recycling. The public space (external) consists of three garbage cans for three types of files; text, video, images (visually). Visitors can search and preview content on a recycled 14-inch monitor and old PC computer, and by reaching deep into the garbage cans they can download it on USB or mobile phone. An important conceptual part is to join a specific smell (olfactory), metaphorically connected with garbage smell, to an abstract form (computer files). Our intention is to add one more dimension of being to virtual products such as digital photos, digital video, or in the future to software applications and digital media

services by collecting sensory information which will evoke memories or associations to objects or situations. Based on that in both of our experiments we focused on:

- production of multisensory experience as more consistent over time;
- creation of environment as an extremely important factor which could direct multisensory integration and perception;
- redefining the users as a creative source;

to achieve that we build two multi-sensory interfaces. In the case of the Art Machine: MindCatcher based on motion, touch, sound and vision and in the case of Re-Digital on vision and smell. Important part for our experiment was to alter users into creative sources, we found interactive art as interesting tool to provoke such transformation [19]. As such, we found the interactive installation to be a proper environment for sensory integration. This was important because stimuli that appear to originate from the same spatial location are more likely to be attributed to a single multisensory source rather than to separate sources [20].

In the interactive installation Art Machine: MindCatcher we tested multisensory experience within twenty participants randomly selected for a contextual in-depth interview. According to their responses, 80% of them described having a creative experience through which they felt they were contributing to the creation of a human being. They were able to visualize 3D shapes based on generated two dimensional representations projected on the screen. The result of the multisensory experience was, as some of them said, “Creative DNA Code” (Fig. 3) where they joined the molecular structure of the body they created to DNA pieces created by other participants (Fig. 4). The fact that they could return and continue their creative act gave them an opportunity to refresh memories of previous sessions and associations to objects done by themselves or others.

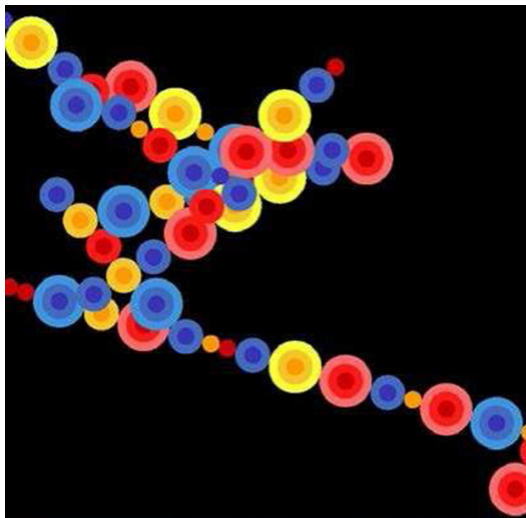


Fig. 3. Art Machine: MindCatcher Individual Creative Sessions

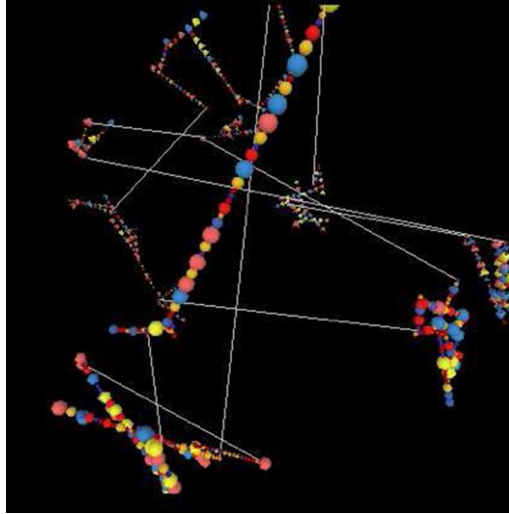


Fig. 4. Art Machine: MindCatcher Group Creative Sessions

In the installation Re-Digital we are focused on merging visual with olfactory experience for long-term perceptual transformation and attribution to new quality of meanings. The experiment is in the phase of collecting relevant data from the different user groups.

4 Conclusion and Future Directions

We believe that interactions between people and various sensory attributes in different modalities could increase structural connectivity and be more consistent over time, if experienced through creative interaction, contribution and aesthetic experience. Our research aims to understand the relationship between interactions, sensory stimuli and product perception with special attention to psychological mechanisms of synesthesia and opportunity to use it in cross-modal user experience design. Synesthesia may help us to understand how combine interaction design concepts and brain capabilities to merge different sensory information into new approach to future multisensory service design.

The projects Art Machine: MindCatcher and Re-Digital are intended to contribute to the field of research where product design utilizes interactive multimodal environments and technologies to involve the user in co-creative activities and better product or service acceptance. The general idea behind that is to explore opportunities to respond to great variety of human perceptions and as such to move the design process into much wider and deeper realms of life. For example, moving away from conventional interfaces mostly designed for screen based interactive products, we consider as a significant product conceptualization change as well as cultural event worth investigating. Also, we suggest that aesthetical experience could play a significant role in the methodological approach. Still, digital media industry does not incorporate enough usage of different sensory modalities in their new products ideation and design. They do not make full use of the multisensory potential of the products that they market/produce, although it plays

important role in a consumer's interactions with the environment [29, 30]. We believe that product and service design strategies lead by multisensory and synesthetic experience logic can take us to more effective interactions between users, products and services and better stimulation of consumer's senses and more pleasurable and memorable brand experience.

References

1. van Leeuwen, T.M., Singer, W., Nikolić, D.: The merit of synesthesia for consciousness research. *Front. Psychol.* **6**, 1850 (2015)
2. Simner, J.: Defining synaesthesia. *Br. J. Psychol.* **103**(1), 1–15 (2012)
3. Afra, P., Anderson, J., Funke, M., et al.: Neurophysiological investigation of idiopathic acquired auditory–visual synesthesia. *Neurocase* **18**(4), 323–329 (2012)
4. Ginsberg, L.: A case of synaesthesia. *Am. J. Psychol.* **34**, 582–589 (1923)
5. Cytowic, R.E.: *The Man Who Tasted Shapes: A Bizarre Medical Mystery Offers Revolutionary Insights Into Reasoning, Emotion, and Consciousness*. Putman, New York (1993)
6. Beeli, G., Esslen, M., Jäncke, L.: Synaesthesia: when coloured sounds taste sweet. *Nature* **434**(7029), 38 (2005)
7. O'Callaghan, C.: Synesthesia vs. crossmodal illusions (2017)
8. Jewanski, J., Simner, J., Day, S.A., Ward, J.: The development of a scientific understanding of synesthesia from early case studies (1849–1873). *J. History Neurosci.* **20**(4), 284–305 (2011)
9. Ramachandran, V.S., Hubbard, E.M.: The phenomenology of synaesthesia. *J. Conscious. Stud.* **10**(8), 49–57 (2003)
10. Wu, Y.L., Chen, P.C.: The Synesthesia effects of Online Advertising Stimulus Design on Word-of-Mouth and Purchase Intention: From the Perspective of Consumer Olfactory and Gustatory (2016)
11. Rich, A.N., Bradshaw, J.L., Mattingley, J.B.: A systematic, large-scale study of synaesthesia: implications for the role of early experience in lexical-colour associations. *Cognition* **98**(1), 53–84 (2005)
12. Stenslie, S.: *Virtual touch: a study of the use and experience of touch in artistic, multimodal and computer-based environments* (2010)
13. Burnham, J.: The aesthetics of intelligent systems. <https://monoskop.org/images/0/02/BurnhamJack1970TheAestheticsofIntelligentSystems.pdf>. Accessed 02 Oct 2019
14. Ascott, R.: *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*. University of California Press, Berkeley (2007)
15. Willats, S.: *Art and Social Function*, Batsford (2002)
16. Walker, J.A., Phillipot, C.: *Glossary of Art, Architecture and Design Since 1945*. Library Association Publishing, Chicago (1992)
17. Giaccardi E.: Interactive strategies of network art. relationships and agency. In: *CADE 1999: Third Conference on Computers in Art & Design Education*. Citeseer (1999)
18. Gonzales, A., Finley, T., Duncan, S.: Interactive art: effects on user identity user satisfaction. In: *CHI 2009 Proceedings of the 27th International Conference on Human Factors in Computing Systems* (2008)
19. Spence, C.: Audiovisual multisensory integration. *Acoust. Sci. Technol.* **28**(2), 61–70 (2007)
20. Tao, C.C., Bucy, E.P.: Conceptualizing media stimuli in experimental research: psychological versus attribute-based definitions. *Hum. Commun. Res.* **33**(4), 397–426 (2007)
21. Vorderer, P., Knobloch, S., Schramm, H.: Does entertainment suffer from interactivity? The impact of watching an interactive tv movie on viewers' experience of entertainment. *Med. Psychol.* **3**(4), 343–363 (2001)

22. Bahrick, L.E., Lickliter, R.: Intersensory redundancy guides attentional selectivity and perceptual learning in infancy. *Dev. Psychol.* **36**(2), 190 (2000)
23. Spence, C.: *The report on the secret of the senses*. The Communication Group, London (2002)
24. Stein, B.E., Meredith, M.A.: *The Merging of the Senses*. The MIT Press, Cambridge (1993)
25. Washburn, D.A., Jones, L.M., Satya, R.V., Bowers, C.A., Cortes, A.: Olfactory use in virtual environment training. *Model. Simul.* **2**(3), 19–25 (2003)
26. Ferreira, A.A., Brito, G., Silva, L.N.D., Mouzinho, J.V., Morais, R., Pereira, J.R.: Synesthesia vision integration with Recife's public transport. In: *Proceedings of the 16th Web For All 2019 Personalization-Personalizing the Web*, p. 15. ACM, May 2019
27. Fleischmann, M., Strauss, W., Bohn, C.A.: Liquid views: rigid waves. In: *ACM SIGGRAPH 98 Electronic Art and Animation Catalog*. ACM, p. 21 (1998)
28. Hayes, S.C., Strosahl, K.D., Wilson, K.G.: *Review of acceptance and commitment therapy: an experiential approach to behavior change* (2002)
29. Schifferstein, H.N., Spence, C.: Multisensory product experience. In: *Product Experience*, pp. 133–161. Elsevier (2008)
30. Sense, L.M.B.: *Build Powerful Brands Through Touch, Taste, Smell, Sight, and Sound*. New York. Free Press (2005)